PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : F24C 3/00 — A2

(11) International Publication Number: WO 99/02923

(43) International Publication Date: 21 January 1999 (21.01.99)

(21) International Application Number: PCT/EP98/04152

(22) International Filing Date: 6 July 1998 (06.07.98)

(30) Priority Data:
MO97A000124 7 July 1997 (07.07.97) IT

(71) Applicant *(for all designated States except US)*: WORGAS BRUCIATORI S.R.L. [IT/IT]; Via A. Coppi, 17, I–41043 Formigine (IT).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: FOGLIANI, Giuseppe [IT/IT]; Via Salvo D'Acquisto, 11, I–41043 Formigine (IT). GUNTHER, Berthold [DE/IT]; Via Mario Bonacini, 119, I–41100 Modena (IT).

(74) Agent: CRUGNOLA, Pietro; Luppi & Crugnola S.r.l., Viale Corassori, 54, I–41100 Modena (IT).

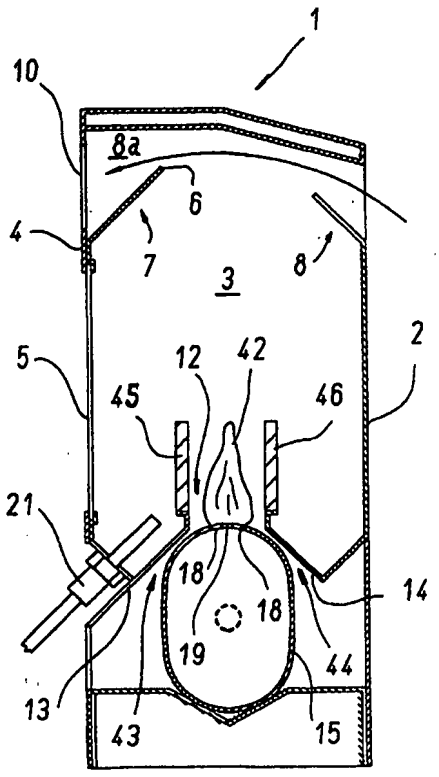
(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).

Published
Without international search report and to be republished upon receipt of that report.

(54) Title: A METHOD OF REDUCING CO AND NOx EMISSIONS IN A HEATING APPLIANCE AND A RESPECTIVE APPLIANCE

(57) Abstract

A method of combustion of a gaseous fuel in a heating appliance (1; 22) provided with at least one burner (15; 29; 34, 35, 36; 38), comprising mixing said gaseous fuel with a preestablished quantity of air to obtain an air–fuel mixture, supplying said mixture to the body of said at least one burner (15; 29; 34, 35, 36; 38), which is provided with a diffuser (19) on which openings (18) are made through which said mixture passes, causing the combustion of said mixture in order to generate flames (20; 32; 33; 34; 37; 42), the method further comprises irradiating heat towards said flames (20; 32; 33; 34; 37; 42) and a region directly surrounding said flames (20; 32; 33; 34; 37; 42). A heating appliance (1; 22) provided with at least one burner (15; 29; 34, 35, 36; 38) fed with a mixture of gaseous fuel and air, said at least one burner (15; 29; 34, 35, 36; 38) being provided with a diffuser (19) having openings (18) through which said mixture passes and with means (21) to cause the combustion of said mixture and the formation of flames (20; 32; 33; 34; 37; 42), the heating appliance further comprises heat irradiating means (47; 45, 46) which are capable of irradiating heat towards said flames (20; 32; 33; 34; 37; 42) and a region directly surrounding said flames (20; 32; 33; 34; 37; 42).



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	**ES**	Spain	**LS**	Lesotho	**SI**	Slovenia
AM	Armenia	**FI**	Finland	**LT**	Lithuania	**SK**	Slovakia
AT	Austria	**FR**	France	**LU**	Luxembourg	**SN**	Senegal
AU	Australia	**GA**	Gabon	**LV**	Latvia	**SZ**	Swaziland
AZ	Azerbaijan	**GB**	United Kingdom	**MC**	Monaco	**TD**	Chad
BA	Bosnia and Herzegovina	**GE**	Georgia	**MD**	Republic of Moldova	**TG**	Togo
BB	Barbados	**GH**	Ghana	**MG**	Madagascar	**TJ**	Tajikistan
BE	Belgium	**GN**	Guinea	**MK**	The former Yugoslav Republic of Macedonia	**TM**	Turkmenistan
BF	Burkina Faso	**GR**	Greece			**TR**	Turkey
BG	Bulgaria	**HU**	Hungary	**ML**	Mali	**TT**	Trinidad and Tobago
BJ	Benin	**IE**	Ireland	**MN**	Mongolia	**UA**	Ukraine
BR	Brazil	**IL**	Israel	**MR**	Mauritania	**UG**	Uganda
BY	Belarus	**IS**	Iceland	**MW**	Malawi	**US**	United States of America
CA	Canada	**IT**	Italy	**MX**	Mexico	**UZ**	Uzbekistan
CF	Central African Republic	**JP**	Japan	**NE**	Niger	**VN**	Viet Nam
CG	Congo	**KE**	Kenya	**NL**	Netherlands	**YU**	Yugoslavia
CH	Switzerland	**KG**	Kyrgyzstan	**NO**	Norway	**ZW**	Zimbabwe
CI	Côte d'Ivoire	**KP**	Democratic People's Republic of Korea	**NZ**	New Zealand		
CM	Cameroon			**PL**	Poland		
CN	China	**KR**	Republic of Korea	**PT**	Portugal		
CU	Cuba	**KZ**	Kazakstan	**RO**	Romania		
CZ	Czech Republic	**LC**	Saint Lucia	**RU**	Russian Federation		
DE	Germany	**LI**	Liechtenstein	**SD**	Sudan		
DK	Denmark	**LK**	Sri Lanka	**SE**	Sweden		
EE	Estonia	**LR**	Liberia	**SG**	Singapore		

A method of reducing CO and NOx emissions in a heating appliance and a respective appliance.

The invention concerns a method of reducing CO and NO_X emissions in a heating appliance, and a respective appliance.

Particularly, the invention may be used in heating appliances which are not provided with a flue, that is, for instance stoves and fireplaces fed with a gaseous fuel, which discharge the combustion products in the room where they are installed.

These appliances are commonly used to heat rooms which are not provided with a flue to convey to the outside the combustion products.

Since the combustion products are discharged in the room where the appliance is installed, there are very restrictive safety rules concerning the allowable content of toxic substances, such as carbon oxide CO and nitrogen oxides, in said combustion products.

The formation of CO in the combustion products depends on a plurality of factors:

- non-complete combustion of the fuel, which may be caused by an insufficient quantity of air in the air-fuel mixture supplied to the appliance;
- cooling of flame during combustion, which may be caused by a contact of the flame with cold surfaces, that is with surfaces having a temperature less than the temperature of the flame, or by a flow of cold air, the so-called secondary air, from the room onto the surface of the flame;
- excess of air in the air-fuel mixture supplied to the appliance, which causes a combustion with a too low temperature of the flame, resulting in a non-complete combustion of the fuel.

With regard to the formation of NO_2, it has been found that said formation does not take place directly at the inside of the flame during combustion, but subsequently in a region directly surrounding the flame wherein NO generated during combustion is oxidised.

Therefore, the formation of NO_2 depends both on the presence of NO in the combustion products and on the presence of oxidisers, such as O_2 and OH radicals, such as, for instance, HO_2 radical, in said region directly surrounding the flame. The quantity of HO_2 radical depends on the temperature of the flame and decreases as the temperature increases.

The quantity of NO_2 the combustion products may be reduced to very low values

by using a bladed flame burner, such as disclosed in EP-B-0373157 and EP-A-0537244, both in the name of the applicant. This burner makes possible to obtain very low contents of NO_2 in the combustion products. However, the use of the above mentioned burner is does not allow to reduce CO emissions to very low values.

If a conventional burner with a "Bunsen" flame is used, it is possible to obtain a low content of CO in the combustion products, but the content of NO_2 continues to be high.

In addition, from EP-A-0512801 a combustion method for a radiant burner and a respective burner being fed with a hyperstoichiometric mixture of gas fuels and air are known, wherein the formation of CO and NO_2 in the combustion products is eliminated or, at least, reduced to very low levels by having the combustion brought about on the surface of the diffuser of the burner, or on in close proximity of said surface, thus limiting the contact of the combustion products with the ambient air, the so-called secondary air.

The above mentioned method, however, is not able to reduce the formation of CO to acceptable levels in bladed flame burners as described in the above mentioned EP-B-0373157 and EP-A-0537244 and the formation of NO_2 in "Bunsen" flame burners, because the flames of both said burners has a substantial height and the combustion does not take place on the surface of the burner or in close proximity of said surface.

In addition, the above method can not be used in a fireplace which is provided with a large front aperture through which the ambient air is free to enter the combustion chamber.

It is an object of the present invention to provide a method of reducing CO and NO_2 emissions in heating appliances without flue, provided with "Bunsen" flame burners or bladed flame burners, such as disclosed in EP-B-0373157 and EP-A-0537244.

A further object of the present invention is to provide a heating appliance with low emissions of CO and NO_2.

According to the present invention there is provided a method of combustion of a gaseous fuel in a heating appliance provided with at least one burner, comprising mixing said gaseous fuel with a preestablished quantity of air, supplying said mixture to the body of said at least one burner, which is provided with a diffuser on which openings are made through which said mixture passes, causing the combustion of said mixture in order to generate at least one flame,

one flame, characterised in that it further comprises irradiating heat towards said at least one flame and a region directly surrounding said flame.

According to a second aspect of the present invention there is provided a heating appliance provided with at least one burner fed with a mixture of gaseous fuel and air, said at least one burner being provided with a diffuser having openings through which said mixture passes and with means to cause the combustion of said mixture and the formation of at least one flame, characterised in that it further comprises heat irradiating means which are capable of irradiating heat towards said at least one flame and a region directly surrounding said flame.

Irradiating heat on the flame and in the region directly surrounding the flame makes it possible to keep in said region a temperature high enough to substantially reduce the formation, and the presence, of CO and NO_2 in the combustion products.

Further features and advantages of the present invention will be explained in the following description, made only by way of non-limiting example, and in the enclosed drawings wherein:

Figure 1 is a cross section of a heating appliance featured as a stove without flue;

Figure 2 is a partly sectioned front view of the heating appliance of Figure 1;

Figure 3 is a section as in Figure 1, concerning variation of the heating appliance of Figure 1;

Figure 4 is a transverse section of a heating appliance featured as a fireplace without flue;

Figures 5 and 6 are transverse sections as in figure 3, concerning variations of the heating appliance of Figure 4.

With reference to Figure 1, 1 denotes a heating appliance featured as a stove, provided with an outer casing 2 inside which a combustion chamber 3 is defined, which is bounded sideways, on the front and on the back by said outer casing 2.

A front portion 4 of said casing 2 is movable in order to have access to said combustion chamber 3, said portion 4 being provided with a glass 5, so that said combustion chamber 3 is visible from the outside.

The combustion chamber 3 is provided with an upper opening 6 in its upper portion, defined by two wall portions 7 and 8 converging upward, said upper opening communicating with a conduit 8a discharging outside the combustion products. The conduit 8a is provided, at a first end facing toward the back side of

products. The conduit 8a is provided, at a first end facing toward the back side of the appliance 1, with a first opening 9 allowing air to enter into the conduit from the outside and, at a second end facing toward the front side of the appliance 1, with a second opening 10 leading, for instance, to a position above said front section 4 of the casing 2 and is provided with a grid 11. The air entering said first opening 9 from the outside is mixed to the combustion products coming from the combustion chamber 3 in order to cool them, so that emission of too hot fumes through the grid 11.

The combustion chamber 3 is further provided with a lower opening 12 defined by two lower wall portions 13 and 14 converging upward. A burner 15, for instance a burner as disclosed in EP-B-0373157 and EP-A-0537244 is arranged below said lower wall portions 13 and 14, so that the body of the burner 15 is forced against said wall portions. Two seal means 16 and 17 are interposed between the burner 15 and said wall portions 13 and 14, so that the inflow of air from the outside through said lower opening 12 into the combustion chamber 3 is prevented.

The mixture of fuel gas and air supplied to the burner 15, passes through openings 18 made in the burner diffuser 19 and penetrates, through said lower opening 12, into said combustion chamber 3, in which the combustion of said mixture takes place, generating a plurality of flames 20, for instance bladed flames, as disclosed in EP-B-0373157 and EP-A-0537244, above said openings 18. The appliance 1 is further provided with a pilot burner 21, designed to ignite the combustion of the mixture supplied to the burner 15.

The walls of the casing 2 defining the combustion chamber 3, with the exception of the front wall 4 provided with glass 5, are provided on the whole of the respective surface, or only on a portion of it, with a lining 47 made of a material capable of accumulate and irradiate heat, for instance a ceramic material. Said lining may be also extended to the upper wall portions 7 and 8 and to the lower wall portions 13 and 14.

During operation of the appliance 1, said lining 47 accumulates heat and irradiates it into the combustion chamber 3, particularly toward the flames 20 and the region directly surrounding the flames, thus allowing the temperature of said region to be maintained so high as to prevent, or at least reduce to very low levels, the formation of CO and NO_2 in the combustion products.

Particularly, when a burner 15, as disclosed in EP-B-0373157 and EP-A-0537244 is used, that is a burner with a very low formation of NO_2, the

accumulation of heat in the lining 47 and its subsequent irradiation, allows, in particular, the formation of NO_2 to be prevented, or reduced to very low levels.

It is to be noticed, that, when the lining 47 is limited only to some regions of the inner surface of the walls of the combustion chamber, said regions are chosen in such a way as the heat accumulated in the lining 47 is irradiated mainly toward the flames 20 and the region directly surrounding the flames.

In Figure 3 a variation of the appliance is illustrated, wherein the lower wall portions 13 and 14 are not in contact with the burner 15, thus defining two passages 43 and 44 through which air from the outside, the so-called secondary air, enter the combustion chamber 3.

With reference now to Figures 4 to 6, they illustrate heating appliances 22 featured as fireplaces without flue, that is heating appliances fed by a burner for gas fuels which simulate a conventional fireplace.

Heat irradiating means 45 and 46 are arranged on respective supports 48 and 49 above the diffuser 19 of the burner 15, substantially for the whole length of that portion of diffuser provided with the apertures 18. said irradiating means, when the appliance 1 operates, irradiate heat toward the flames 42 and in the region directly surrounding the flames.

Said heat irradiating means 45 and 46 may comprise heat accumulating means made of a material capable of accumulating heat and irradiate it, for instance a ceramic material. Alternatively, said irradiating means may comprise heat reflecting means, such as, for instance, parabolic mirrors. In addition, said irradiating means 45 and 46 may comprise heat generating means, for instance electric resistance heat generating means.

The use of said irradiating means 45 and 46 is particularly advisable when burners with "Bunsen" flames are used, which need secondary air for a proper operation and when the burner 15 is fed with liquid gas fuel, because it is more likely the formation of NO_2 in the combustion products when said kind of fuel is used.

In figures 4, 5 and 6 heating appliances without flue according to the invention, featured as fireplaces, are shown.

Said appliances comprise a casing 23 inside which a combustion chamber 24 is defined, which is provided with a front opening 25 communicating with the outside and with an upper opening 26 through which the combustion products are discharged. Inside the combustion chamber 24 one or more elements 28, made of a material resistant to high temperatures, for instance made of ceramic

ceramic material and simulating bits of wood, are arranged on respective supports 27 provided with apertures, for instance grid supports.

In a first embodiment of the appliance 22, shown in Figure 4, a burner 29 is arranged below the support 27, said burner having a body divided into two sections 30 and 31 fed independently. A first section 30 is capable of generating first violet coloured flames 32, for instance bladed flames as disclosed in EP-B-0373157 and EP-A-0537244, which get in touch with said elements 28 increasing their temperature up to red heat, in order to simulate embers of a conventional fireplace.

The second section 31 of the burner 29 is capable to generate second yellow "Bunsen" flames, which simulate the flames generated by the combustion of a piece of firewood in a conventional fireplace.

The second section 31 of the burner 29 is arranged in such a way as the second flames 33 are located between the first flames 32 and the front opening 25 of the appliance 22. Owing to this arrangement, the second flames 33 and/or a natural circulation of the column of hot combusted gases produced by said flames constitute a barrier preventing air entering the combustion chamber 24 from the outside, which allows a so high temperature to be maintained in the combustion chamber and, particularly, in the region directly surrounding the flames 32 and 33, as to reduce the formation of CO and NO_2 in the combustion products of the first flames 32.

The reduction of formation of CO and NO_2 in the combustion products may be optimised if the first section 30 of the burner 29 is made like a bladed flame burner, as disclosed in EP-B-0373157 and EP-A-0537244. A further reduction of the formation of NO_2 may be obtained if the thermal power produced by said first section 30 is not less than the thermal power produced by said second section, preferably substantially higher. For instance, the thermal power produced by said second section may be between 20% to 30% of the total thermal power of the burner 29.

Figure 5 shows a second embodiment of the appliance 22, wherein three burners are arranged below the support 27: a first central burner 34, for instance a burner like that disclosed in EP-B-0373157 and EP-A-0537244, capable of generating first violet flames 32, e second front burner 35, capable of generating second yellow "Bunsen" flames 33 and a third rear burner 36 capable of generating third yellow "Bunsen" flames 37, which simulate the flames generated by the combustion of pieces of firewood in a conventional fireplace. Said third

fireplace. Said third burner 36 is arranged in such a way as said third flames 37 are more remote from said front opening 25 than said second flames 32 are and may be seen, for instance, behind said elements 28, when one look at the combustion chamber through the front opening 25, which improves the visual simulation of the combustion of pieces of firewood in a conventional fireplace.

Even in said second embodiment of the appliance 22, the second flames 33 generated by the second burner 35 and/or a natural circulation of the respective column of hot combusted gases constitute a barrier against the penetration of air into the combustion chamber 24 from the outside.

Even in said second embodiment, in order to optimise the reduction of the formation of NO_2 in the combustion products, it is advisable that the thermal power generated by the first burner 34 is not less, or preferably substantially higher, than the thermal power generated by the second burner 35 and third burners 36 together.

Figure 6 shows a third embodiment of the appliance 22 according to the invention, which is provided with a single burner 38 having a body divided into three section fed separately: a first central section 39 capable of generating said first flames 32, for instance bladed flames such as disclosed in EP-B-0373157 and EP-A-0537244, a second front section 40 capable of generating said second flames 33 and a third rear section 41 capable of generating said third flames 37.

Even in said third embodiment of the appliance 22, it is advisable that the thermal power generated by said first central section 39 is not less, preferably substantially higher, than the thermal power generated by said second front section 40 and said third section 41 together.

All the embodiments of the appliance 22 shown in Figures 4, 5 and 6 may have the walls of the combustion chamber 24 provided with a lining 47 made of a material capable of accumulating heat.

The exemplary embodiments of the invention shown concern heating appliances without flue, but the invention may be equally used in heating appliances provided with flue.

CLAIMS

1. A method of combustion of a gaseous fuel in a heating appliance (1; 22) provided with at least one burner (15; 29; 34, 35, 36; 38), comprising mixing said gaseous fuel with a preestablished quantity of air to obtain an air-fuel mixture, supplying said mixture to the body of said at least one burner (15; 29; 34, 35, 36; 38), which is provided with a diffuser (19) on which openings (18) are made through which said mixture passes, causing the combustion of said mixture in order to generate flames (20; 32; 33; 34; 37; 42), characterised in that it further comprises irradiating heat towards said flames (20; 32; 33; 34; 37; 42) and a region directly surrounding said flames (20; 32; 33; 34; 37; 42).
2. A method according to claim 1, wherein said irradiating is obtained by means of heat accumulating means (47; 45, 46).
3. A method according to claim 1, wherein said irradiating is obtained by means of heat reflecting means (45, 46).
4. A method according to claim 1, wherein said irradiating is obtained by means of heat generating means (45, 46).
5. a method according to any one of preceding claims, further comprising limiting the inflow of air from the outside of said appliance (1; 22) into said region directly surrounding said flames (20; 32; 33; 34; 37; 42).
6. A method according to claim 5, wherein said limiting is obtained by means of gaseous barrier means (33).
7. A method of combustion of a gaseous fuel in a heating appliance (1; 22) provided with at least one burner (15; 29; 34, 35, 36; 38), comprising mixing said gaseous fuel with a preestablished quantity of air to obtain an air-fuel mixture, supplying said mixture to the body of said at least one burner (15; 29; 34, 35, 36; 38), which is provided with a diffuser (19) on which openings (18) are made through which said mixture passes, causing the combustion of said mixture in order to generate flames (20; 32; 33; 34; 37; 42), limiting the inflow of air from the outside of said appliance (1; 22) into a region directly surrounding said flames (20; 32; 33; 34; 37; 42), said limiting being obtained by means of gaseous barrier means, characterized in that said gaseous barrier means is obtained by means of natural circulation of gaseous means.
8. A method according to claim 6, wherein said gaseous barrier means comprises flames (33) generated by the combustion of said mixture and/or

the combusted gas generated by said flames (33).

9. A method according to one of claims 6 to 8, wherein said gaseous barrier means (33) are arranged between an opening (25) of a combustion chamber (24) of said appliance (1; 22) communicating with the outside and the combustion chamber (24).
10. A heating appliance (1; 22) provided with at least one burner (15; 29; 34, 35, 36; 38) fed with a mixture of gaseous fuel and air, said at least one burner (15; 29; 34, 35, 36; 38) being provided with a diffuser (19) having openings (18) through which said mixture passes and with means (21) to cause the combustion of said mixture and the formation of flames (20; 32; 33; 34; 37; 42), characterised in that it further comprises heat irradiating means (47; 45, 46) which are capable of irradiating heat towards said flames (20; 32; 33; 34; 37; 42) and a region directly surrounding said flames (20; 32; 33; 34; 37; 42).
11. A heating appliance according to claim 10, wherein said at least one burner (15) is capable of generating bladed flames.
12. A heating appliance according to claim 10, or 11, wherein said irradiating means (47; 45, 46) comprises heat accumulating means.
13. A heating appliance according to claim 12, wherein said heat accumulating means (47; 45, 46) comprises ceramic material.
14. A heating appliance according to claim 12, or 13, wherein said heat accumulating means comprises a lining (47) of an inner surface of walls a combustion chamber (3; 24) defined at the inside of a casing (2; 23) of said heating appliance (1; 22).
15. A heating appliance according to claim 14, wherein said lining (47) extends to the whole inner surface of said walls.
16. A heating appliance according to claim 14, wherein said lining is limited to preestablished portions of said inner surface.
17. A heating appliance according to claim 10, or 11, wherein said heat irradiating means comprises heat reflecting means (45, 46).
18. A heating appliance according to claim 10, or 11, wherein said heat irradiating means comprises heat generating means (45, 46).
19. A heating appliance according to claim 18, wherein said heat generating means (45, 46) comprises electric resistance heat generating means.
20. A heating appliance according to one of claims 12, 13, 17, 18, 19, wherein said heat irradiating means are arranged close to the surface of said

diffuser (19) substantially through that portion of diffuser (19) provided with said openings (18).

21. A heating appliance according to one of claims 10 to 20, further comprising barrier means (13, 14, 16, 17, 33) capable of limiting the inflow of air from the outside into said heating appliance (1; 22) in a region directly surrounding said flames (20; 32; 33; 34; 37; 42).

22. A heating appliance according to claim 21, wherein said barrier means comprises upward converging lower wall portions (13, 14) of a combustion chamber (3) defined at the inside of a casing (2) of the heating appliance (1), said at least one burner (15) being arranged below said lower wall portions (13, 14), sealing means (16, 17) being arranged between said lower wall portions (13, 14) and said at least one burner (15), said lower wall portions (13, 14) defining at least one passage (12) for said mixture of gas fuel and air.

23. A heating appliance according to claim 22, wherein said at least one burner (15) is arranged so as to exert a pressure against said sealing means (16, 17).

24. A heating appliance according to claim 21, wherein said barrier means comprises gaseous barrier means.

25. A heating appliance (1; 22) provided with at least one burner (15; 29; 34, 35, 36; 38) fed with a mixture of gaseous fuel and air, said at least one burner (15; 29; 34, 35, 36; 38) being provided with a diffuser (19) having openings (18) through which said mixture passes and with means (21) to cause the combustion of said mixture and the formation of flames (20; 32; 33; 34; 37; 42), said heating appliance comprising barrier means (13, 14, 16, 17; 33) capable of limiting the inflow of air from the outside into said heating appliance in a region directly surrounding said flames (20; 32; 33; 34; 37; 42), said barrier means comprising gaseous barrier means (33), characterized in that said gaseous barrier means is obtained by means of natural circulation of gaseous means.

26. A heating appliance according to claim 24, wherein said gaseous barrier means comprises flames (33) generated by the combustion of said mixture and/or the respective combusted gas generated by said flames.

27. A heating appliance according to one of claims 24 to 26, wherein said gaseous barrier means (33) are arranged between an opening (25) of a combustion chamber defined at the inside of a casing (23) of the heating

appliance (22) and the combustion chamber itself, said opening (25) communicating with the outside of the heating appliance (22).

28. A heating appliance according to one of claims 24 to 27, wherein said at least one burner (29) comprises a body divided into two sections (30, 31) fed independently: a first section (30) capable of generating first flames (32) and a second section (31) capable of generating second flames (33), said second flames (33) and the combusted gas generated by said second flames (33) constituting said gaseous barrier means.
29. A heating appliance according to claim 28, wherein said first section (30) is capable of generating bladed flames.
30. A heating appliance according to claim 28, or 29, when appended to claim 27, wherein said second section (31) is arranged in such a way as the second flames (33) are interposed between said first flames (32) and said opening (25).
31. A heating appliance according to one of claims 28 to 30, wherein said first section (30) generates a thermal power at least equal to the thermal power generated by said second section (31).
32. A heating appliance according to one of claims 24 to 27, wherein said at least one burner (34, 35) comprises a first burner (34) generating first flames (32) and second burners (35) generating second flames (33), said second flames (33) and the combusted gases generated by said second flames (33) constituting said gas barrier means.
33. A heating appliance according to claim 31, wherein said first burner (34) is capable of generating bladed flames.
34. A heating appliance according to claim 31, or 32, when appended to claim 27, wherein said second burner (35) is arranged in such a way as said second flames (33) are interposed between said first flames (32) and said opening (25).
35. A heating appliance according to one of claims 31 to 34, further comprising a third burner (36) generating third flames (37).
36. A heating appliance according to claim 35, wherein said third burner (36) is arranged in such a way as said third flames (37) are more remote from said opening (25) than said second flame (33) is.
37. A heating appliance according to claim 35, or 36, wherein said first burner (32) generates a thermal power at least equal to the thermal power generated by said second burner (35) and said third burner (36) together.

38. A heating appliance according to one of claims 24 to 27, wherein said at least one burner comprises a body divided into three sections (39, 40, 41) fed independently: a central section (39) capable of generating first flamea (32), a second front section (40) capable of generating second flames (33) and a rear section (41) capable of generating third flames (37), said second flames (33) and the combusted gases generated by said second flames (33) constituting said gas barrier means.

39. A heating appliance according to claim 38, wherein said central section (39) is capable of generating bladed flames.

40. A heating appliance according to claim 38, or 39, when appended to claim 27, wherein said front section (40) is arranged in such a way as said second flames (33) are interposed between said first flames (32) and said opening (25).

41. A heating appliance according to one of claims 38 to 40, wherein said central section (39) generates a thermal power at least equal to the thermal power generated by said front section (40) and said rear section (41) together.

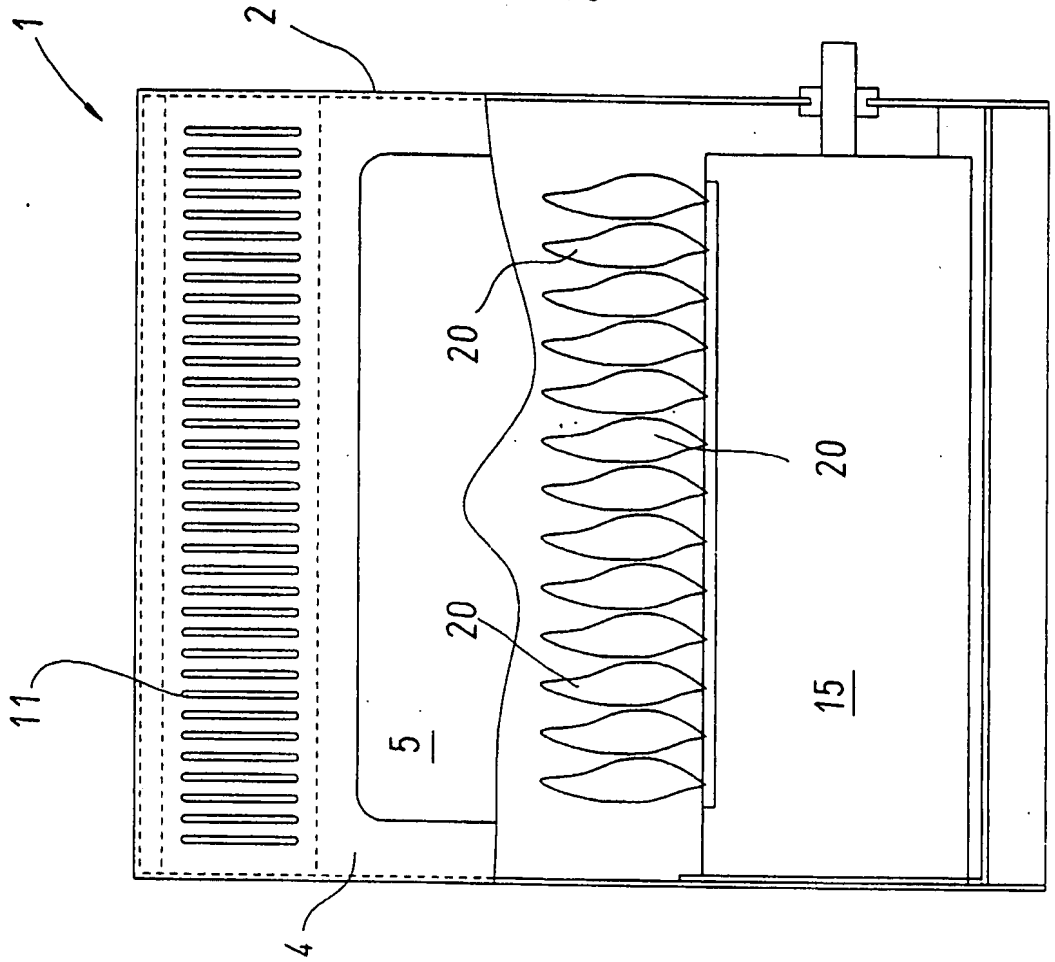


Fig.2

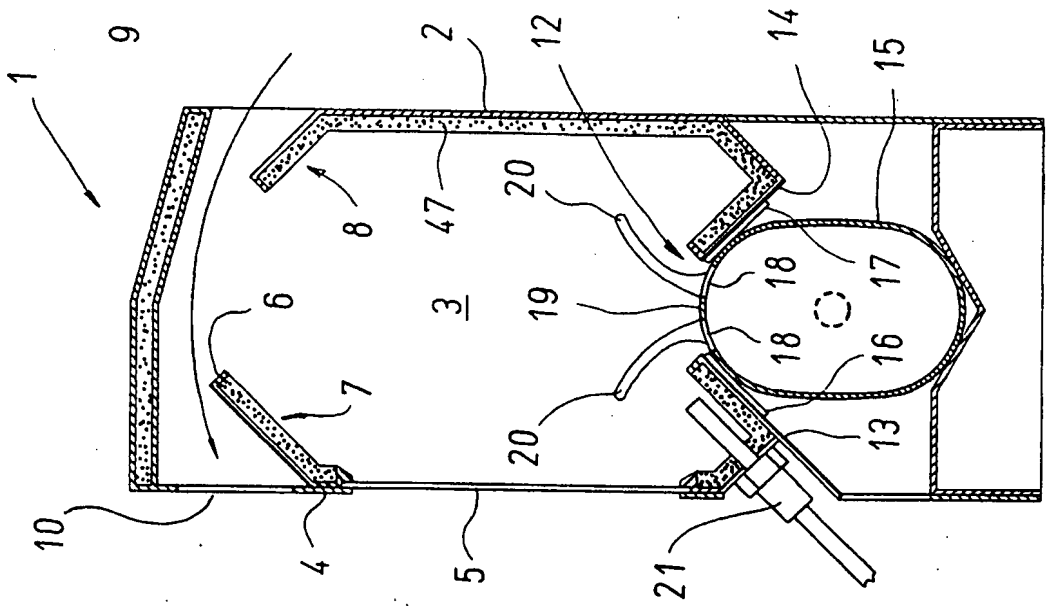


Fig.1

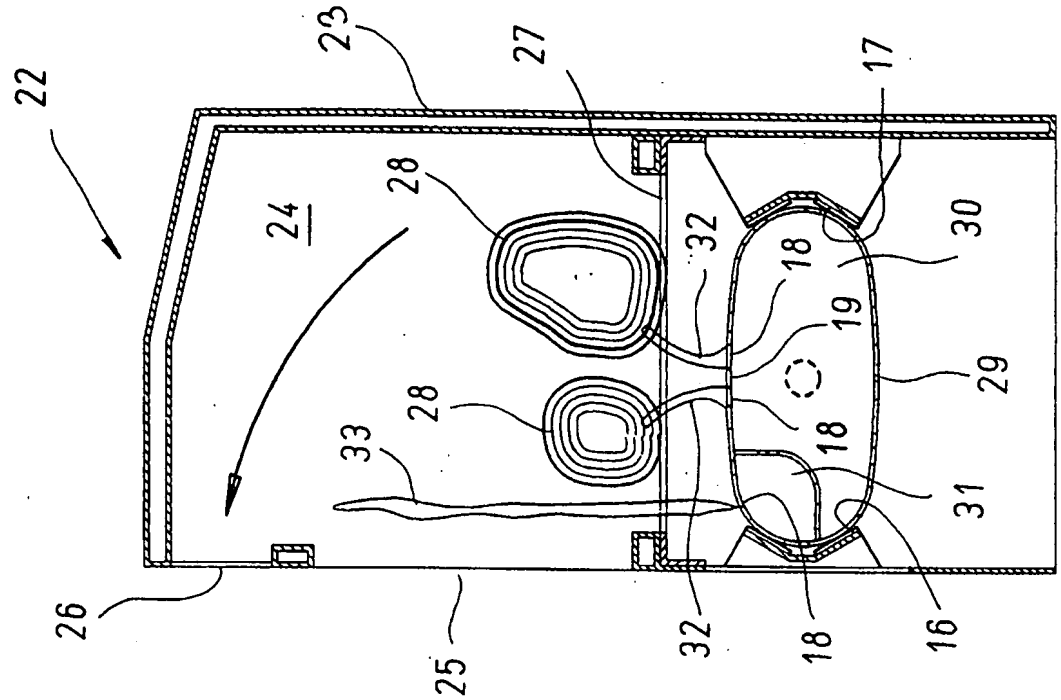


Fig.4

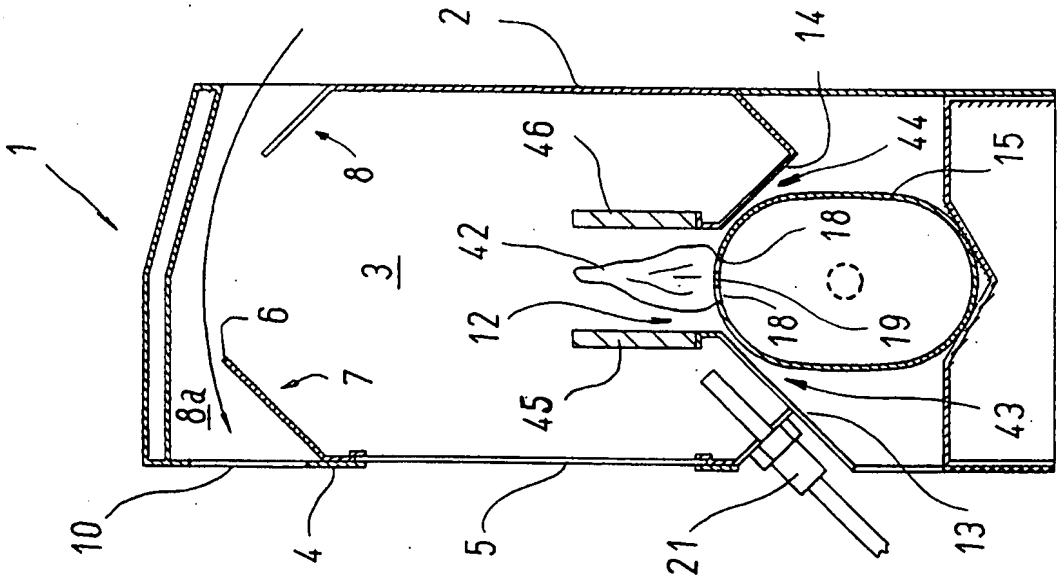


Fig.3

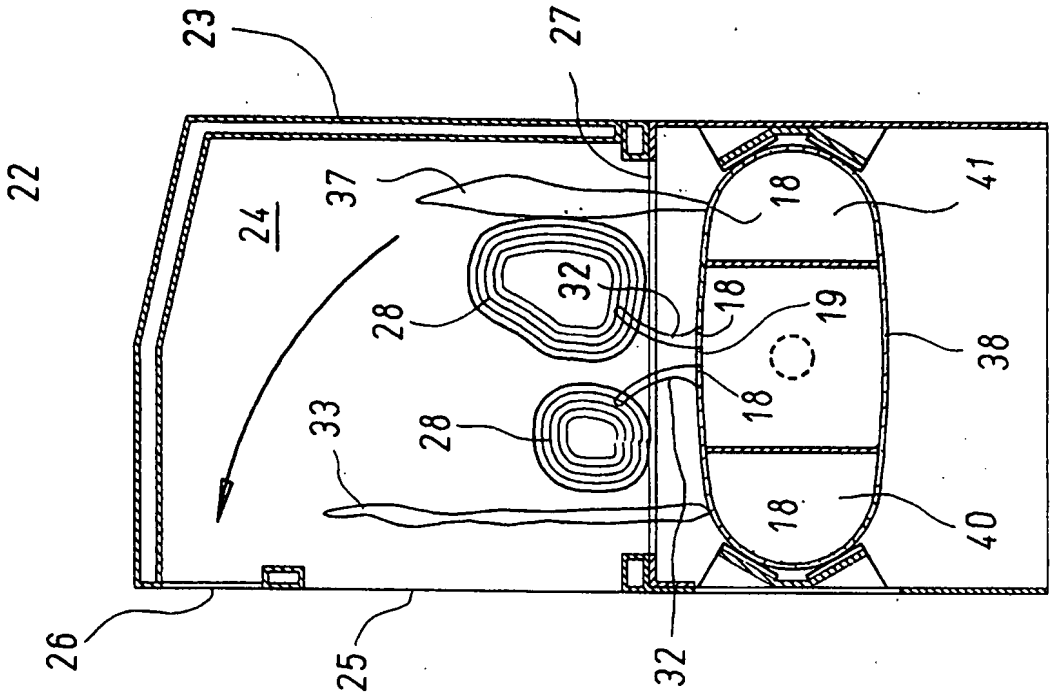


Fig.6

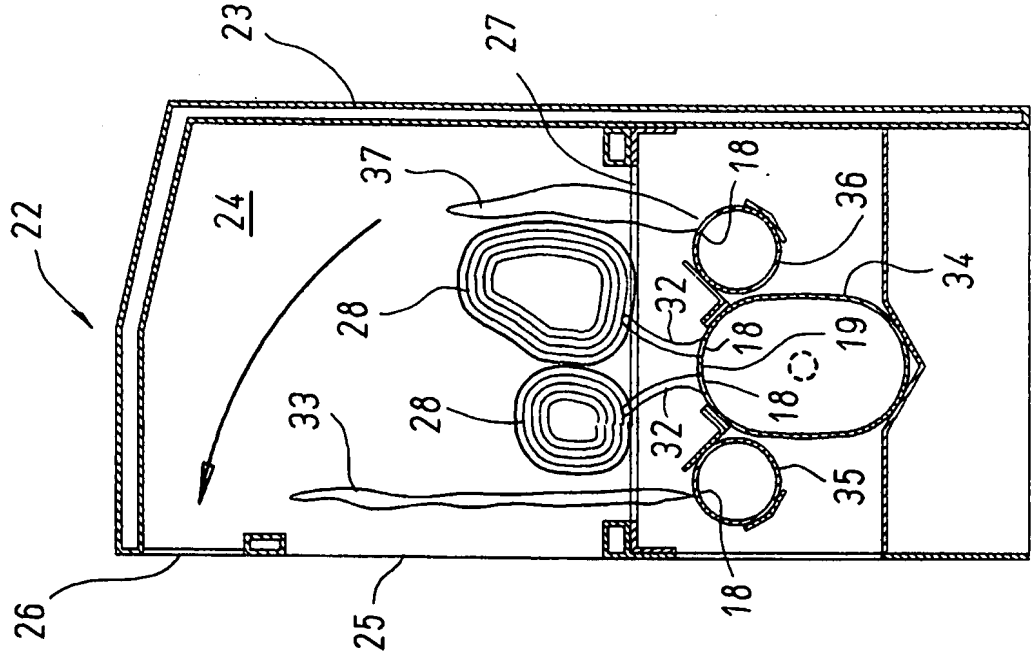


Fig.5